REMARKS

The official action of 30 July 2008 has been carefully considered and reconsideration of the application as amended is respectfully requested.

The submission of a replacement drawing sheet is done to correct an inadvertent clerical omission in Fig. 4, wherein a symbol was omitted that indicates that the throttle valve 82 is adjustable. Thus, insertion of the arrow in Fig. 4 merely serves to indicate that the throttle valve 82 is an adjustable throttle valve. Support for this amendment appears in the specification as filed on page 8, line 22 and in original claim 3.

Claim 1 has been amended to recite that the piston rod (39) projects from only one end of the cylinder (see specification at, e.g., page 5, lines 21-24 and drawings) and that the total volume of the two claimed compartments varies as the door opens and closes (see specification at, e.g., page 9, lines 13-16 and drawings).

New claim 13 has been added more completely to define the subject matter which Applicant regards as his invention. Support for the recitations in this claim appears in the specification as filed at, for example, page 5, line 1 to page 9, line 16 and the corresponding figures of the drawings.

The amendments to the claims remove the basis for the Examiner's

objection at paragraph 1 of the official action. All claims as amended are respectfully believed to be sufficiently definite to satisfy the dictates of 35 USC 112, second paragraph.

The claims stand rejected under 35 USC 103(a) as allegedly being unpatentable over Soczka in view of Isley et al. Applicant respectfully traverses this rejection.

As discussed above, the claims as amended require that the rod (39) projects from only one end of the cylinder and that the total volume of the compartments (64,66) varies as the door opens and closes. These features of the claimed invention are not shown or suggested in the cited references and, indeed, the primary reference, Soczka, discloses an arrangement in which the total volume of the compartments in the cylinder remains constant. The provision of a varying total volume is contrary to accepted design practice, counterintuitive and nonobvious, as next discussed in more detail.

Soczka and Isley disclose hydraulic dampening devices for dampening movement in at least one direction of a door of a bucket of a mechanical shovel. In particular, Soczka discloses a linear hydraulic device which is constructed to dampen movement of a door of a bucket of a mechanical shovel during both opening and closing of the door. Isley, on the other hand, discloses a rotary hydraulic device which is constructed to dampen movement of a door of a bucket of a mechanical shovel during closing of the door. Neither Soczka nor Isley, nor

any combination thereof, makes possible the construction of a buffering or dampening device which allows for the aforementioned change in volume.

Doors of the type in question are arranged to close under gravity. Such doors are typically constructed of steel, so that they are extremely heavy and, accordingly, during movement of these doors, dampening devices for dampening movement of the doors are, as described in lines 49 – 51 of column 1 of Isley, subjected to extreme forces. As will be appreciated, such forces are at a maximum during opening of a door of a loaded bucket, when the dampening device is subjected to forces exerted thereon, not only by the weight of the door, but also by forces exerted by the weight of a load contained in the bucket on the door. It follows that, because it is subjected to such extreme forces, a dampening device of the type in question is prone to wear and other types of damage.

There thus exists a problem with dampening devices of the type in question, in that, because of the aforedescribed wear or damage, they periodically need to be repaired or replaced, which, as will be appreciated, results in down-time of an associated mechanical shovel. Such down-time, in turn, leads to a loss in production time at a worksite where a shovel in question is used, which, especially in industries such as the mining industry where shovels in question are usually used continually, typically results in substantial financial loss.

The claimed invention, as defined in Claim 1, provides for construction of a dampening device (as shown in the drawings and described in the specification of the present application) that provides a solution to the aforementioned problem, in that it makes possible construction of a dampening device which, for the reasons set forth below, is less prone to wear and other types of damage than the devices of Soczka and Isley. This, in turn, means that less frequent maintenance will be required on a device in accordance with the present invention, than is the case with the devices of Soczka and Isley.

In the example shown in the drawings and described in the specification, the two compartments 64, 66 of the piston-and-cylinder assembly 22, and the fluid flow connection therebetween, i.e. the fluid flow control assembly 72 and the flow lines 74, 76 providing the fluid flow communication between the two compartments via the fluid flow control assembly, form a closed (hydraulic) system. As mentioned above, the present invention, as claimed in Claim 1, unlike Soczka or Isley, permits construction of a buffering or dampening device having such closed system.

As will be appreciated, and as described in lines 13 – 16 on page 9 of the description on file, the piston rod 39 of the buffering or dampening device 22 occupies part of the volume of the closed system. In particular, part of the piston rod 39 is located in the compartment 66 adjacent that end of the cylinder from which the piston rod projects. As will further be appreciated, and as highlighted in lines 13 – 16 on page 9 of the description on file, the volume of the

compartment 66 changes differently from the change in volume of the compartment 64 upon displacement of the piston relative to the cylinder, i.e. upon movement of the door, resulting in a change in volume of the closed system. This is because the part of the compartment 66 occupied b the piston rod 39 changes at the same time, whereas there is no rod in the compartment 64. The volume of the closed system thus increases as the piston-and-cylinder assembly 22 extends, because progressively less space in the compartment 66 (and hence progressively less space in the closed system) is occupied by the piston rod 39, and the volume of the closed system decreases as the piston-and-cylinder assembly 22 retracts, because progressively more space in the compartment 66 (and in the closed system) is occupied by the piston rod 39. Claim 1 requires opening of the door to cause the piston-and-cylinder assembly 22 to retract and closing of the door to cause the piston-and-cylinder assembly to extend. Thus, upon opening of the door, the volume of the closed system decreases, and upon closing of the door, the volume of the closed system increases. Neither Soczka nor Isley, nor any combination of Soczka and Isley, can provide for the aforedescribed change in volume, the purpose and advantages of which are addressed hereunder.

The closed system, in use, contains a volume of hydraulic working fluid, which volume substantially equals the volume of the closed system when the piston-and-cylinder assembly is fully retracted, i.e. when the maximum part of the compartment 66 adjacent that end of the cylinder from which the piston rod 39 projects, is occupied by the piston rod 39. Because the piston-and-cylinder

assembly 22 of the present invention extends during closing of the bucket door, the volume of the closed system, as hereinbefore described, increases progressively as less space in the compartment 66, and accordingly in the closed system, is occupied by the piston rod 39. Thus, as the piston-and-cylinder assembly 22 extends with closing of the door and the piston rod occupies progressively less space in the compartment 66, there is insufficient hydraulic working fluid in the closed system to occupy the entire volume of the closed system, which results in the closed system's being subject to a pressure drop. Upon extension of the piston-and-cylinder assembly, under influence of the weight of the door of the bucket moving towards its closed condition, the pressure in the closed system drops sufficiently to cause cavitation, i.e. formation of bubbles of hydraulic fluid vapour (and of any air dissolved in the hydraulic fluid) in the hydraulic fluid in the closed system. The potential and kinetic energy associated with the position and speed of movement of the door is sufficient fully to extend the piston-and-cylinder assembly. Thus, when the piston-and-cylinder assembly is fully extended, i.e. when the door is in its closed condition, the working fluid in the closed system is, as mentioned, under minimum pressure, which means that retraction of the piston-and-cylinder assembly is, at least initially, facilitated.

Although flow of the hydraulic fluid from the compartment 64 to the compartment 66 via the assembly 72 and the flow lines 74, 76 upon retraction of the piston-and-cylinder assembly, i.e. upon opening of the door, is not specifically throttled, as is the case with flow in the other direction, it will be appreciated that free flow

of the hydraulic working fluid upon retraction of the piston-and-cylinder assembly is to an extent restricted by friction.

As mentioned, however, because the hydraulic working fluid in the closed system contains vapour/ air bubbles or a vapour space when the piston-and-cylinder assembly is extended, and the door is closed, subsequent opening of the door urges the piston-and-cylinder assembly 22 to retract. Movement of the door from its closed condition towards its open condition under gravity, and under influence of a force exerted thereon by a load to be discharged from the bucket, when the latch of the bucket is released, is thus initially assisted and facilitated by the hydraulic working fluid's containing vapour/air bubbles. Thus, when the latch which retains the door in its closed condition, is released so that the door is free to move towards its open condition, the bubbles/vapour space in the hydraulic fluid collapse as the door initially moves towards its open condition. The bubbles/vapour space in the closed system thus progressively collapses as the door moves towards its open condition.

Because of said collapsing of the bubbles/vapour space, little hydraulic fluid flow from the compartment 64 to the compartment 66 takes place when the door first starts moving towards its open condition, so that opening movement of the door is more or less unrestricted. In fact, initial movement of the door is promoted and assisted by the pressure of said bubbles/vapour space. As the door approaches its open condition, and as the bubbles/vapour space progressively disappear and flow of hydraulic fluid from the compartment 64 to the compartment 66

commences, which although not throttled, frictionally retards retraction of the piston-and-cylinder assembly, with a consequential retardation of the speed of movement of the door towards its open condition.

Thus, when the latch of the bucket is released, movement of the door from its closed condition towards its open condition is initially more or less unrestricted, which means that a load in the bucket is rapidly discharged therefrom, and stress, which could be considerable, exerted on the piston-and-cylinder assembly by the weight of the door and the load as the door moves away from its closed condition and the load is discharged, is restricted, thereby reducing damage to the piston-and-cylinder assembly by such stress. Further, because of said subsequent retardation of the speed of movement of the door as it approaches its fully open condition, movement of the door as it approaches its fully open condition is damped in a controlled fashion, thereby reducing the impact when the door reaches its fully open condition, again reducing damage to the bucket.

As will be appreciated, with the buffering or dampening device of the present invention constructed in accordance with Claim 1, the likelihood of wear or damage by impact or stress to the buffering or dampening device is less than is the case with the cited prior art. By reducing the likelihood of wear or damage to the buffering or dampening device, the likelihood of reduced downtime of a mechanical shovel due to breakdown of or required maintenance to the buffering or dampening device is reduced, which, in turn, not only results in maintenance

cost-savings, but also results in higher productivity of a mechanical shovel.

The claimed invention thus provides a bucket whose door is caused to move in a buffered or dampened fashion from its open condition to its closed condition. By virtue of the particular construction of the buffering or dampening device, construction of which is only permitted by the claimed invention as defined in Claim 1, the present invention, unlike Soczka or Isley, has the important advantage that movement of the door of the bucket is promoted and assisted as it leaves its closed condition and moves towards its open condition, whilst movement of the door, as the door approaches its open condition, is retarded, relative to said initial movement, so that the present invention, unlike Soczka or Isley, addresses the aforestated problem.

The problem solved by the claimed invention and the fashion by which it solves it are subtle and unexpected and not shown or suggested by the cited references. As discussed, the claimed invention provides for rapid initial closing of the door, followed by slow later opening thereof to protect it as it nears and reaches its fully open condition. The claimed invention thus solves a problem embodied by the prior art, and indeed by Soczka and Isley, no combination of which can provide for rapid initial door opening, followed by later slower opening as the door's fully open condition is neared and reached. Accordingly, the cited references cannot be considered to set forth even a prima facie case of obviousness for the invention as defined in the amended claims.

For the above reasons, Applicant respectfully submits that all rejections and objections of record have been overcome and that the application is now in allowable form. An early notice of allowance is earnestly solicited and is believed to be fully warranted.

Respectfully submitted,

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